

# PLEISTOCENE MOLLUSCAN FAUNULES OF THE SIDNEY CUT, SHELBY COUNTY, OHIO

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## INTRODUCTION

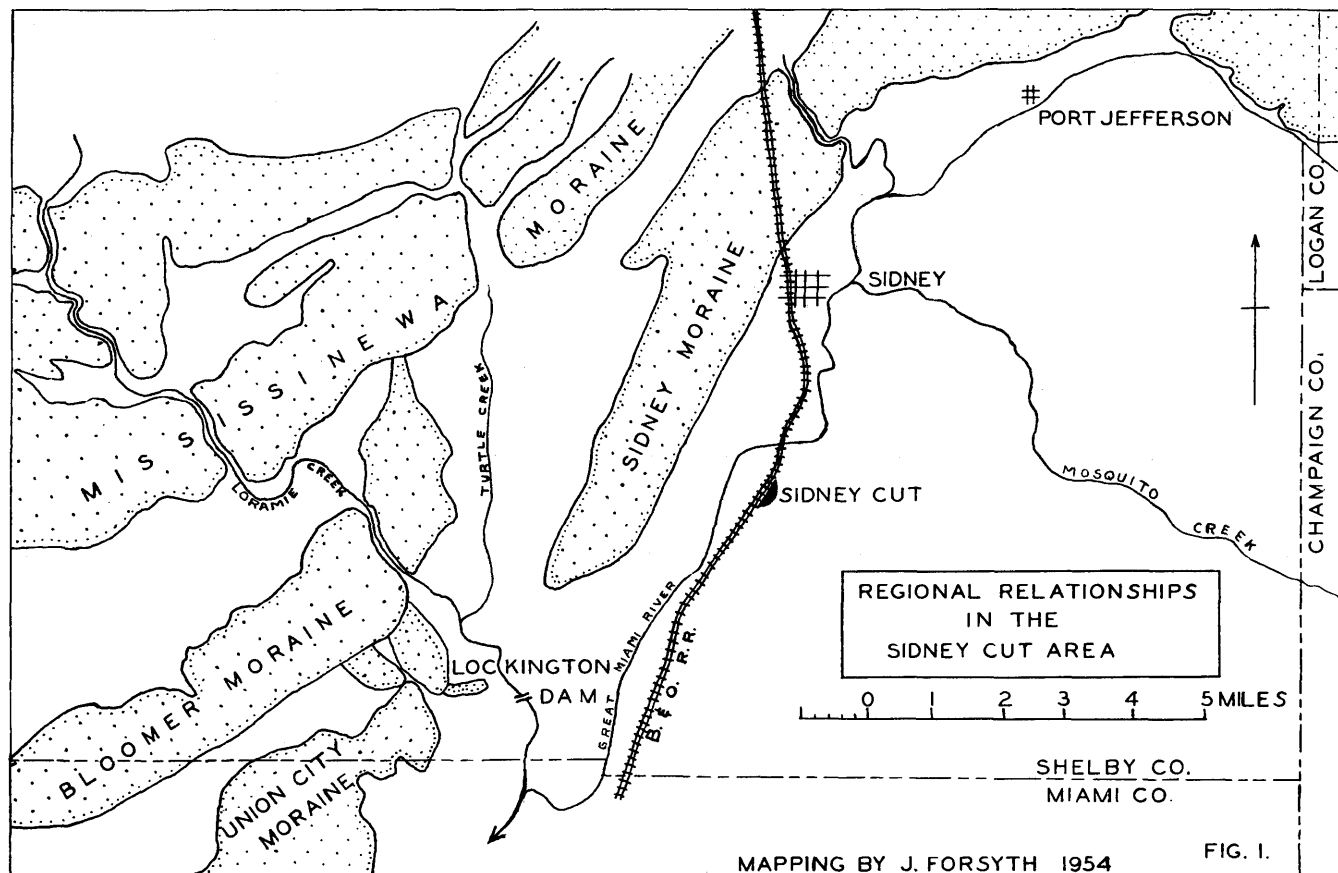
The Sidney cut, from which the fossil mollusks were obtained, lies two miles south of Sidney along the Baltimore and Ohio Railroad (fig. 1). The section is present in steep cuts on both sides of the tracks, but the mollusk-bearing strata are exposed only at one spot near the base of the east cut. This is the same section from which has been recovered Pleistocene wood, present on top of a rather well-developed soil formed in till. The wood is dated at  $23,000 \pm 800$  years (W-188, Rubin and Suess, 1955, p. 483). This section plays an important role in the conclusions of a paper by Flint and Rubin (1955, p. 651), in which they suggest a simpler, twofold division of the Wisconsin stage.

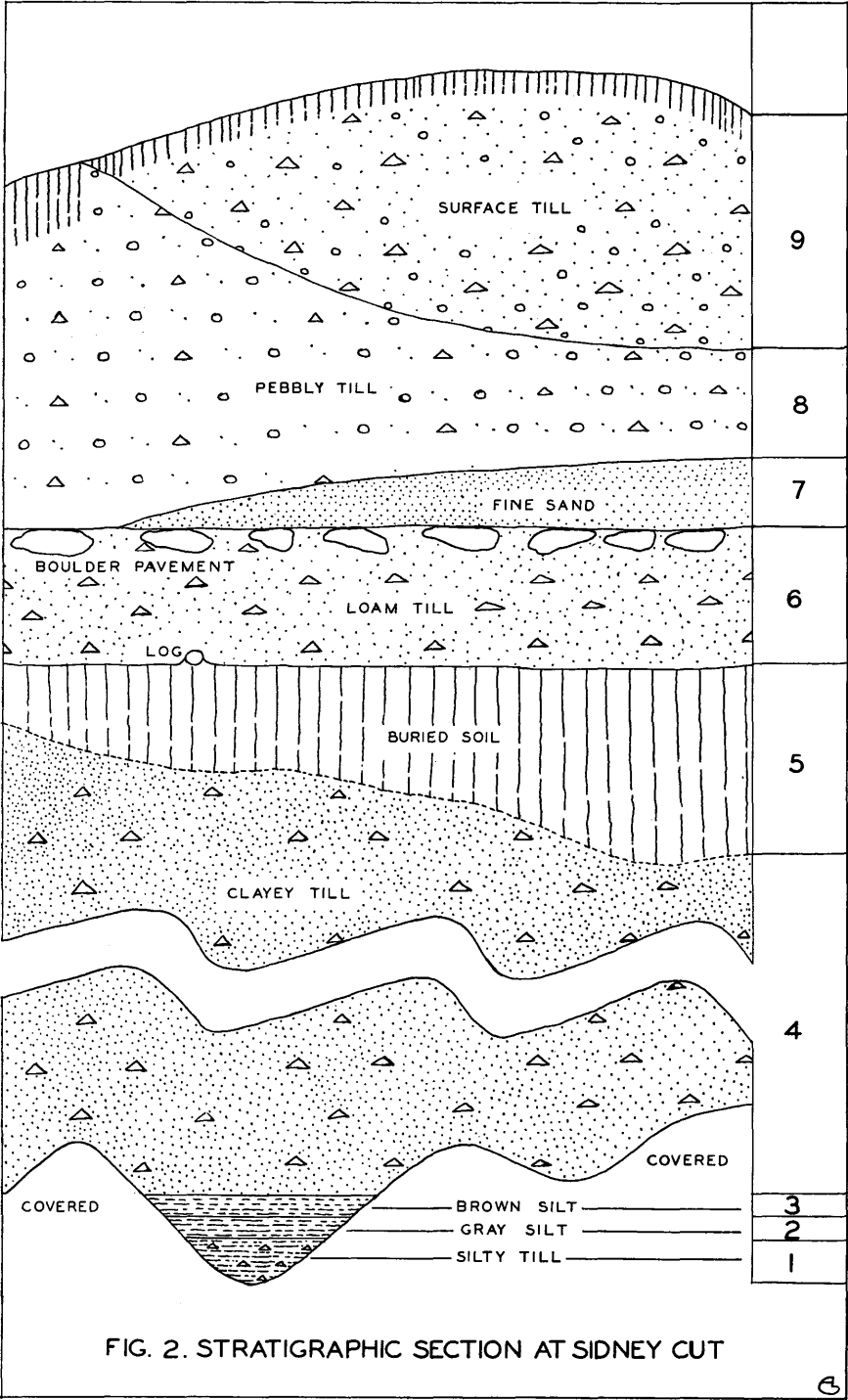
The mollusk-bearing strata lie at the base of the section (fig. 2), below the wood and the till which contains the buried soil. Because the buried soil appears quite well developed, it has been called late Sangamon by some geologists and soils scientists. Should this soil be so interpreted, deposits of "Early" Wisconsin time<sup>1</sup> must be entirely lacking. The stratigraphic position of this soil is very like that of other buried soils developed in gravel at a large number of widely scattered locations in west-central Ohio. These soils appear to show less development than the soil in the Sidney cut and are interpreted as mid-Wisconsin by Goldthwait (1955, p. 41) on the basis of their similarity to modern gravel soils. The stratigraphic position of the buried soil in the Sidney cut suggests that it also might be mid-Wisconsin.

The age of the soil, then, is not clear. Since this soil and this section are a focus for arguments regarding the nature of the subdivision of the Wisconsin, it is essential to consider any new evidence concerning the age of the soil. Discovery of mollusks from a silt below the thick till in which the soil is developed could provide a clue.

Radiocarbon dates from a stream cut on upper Brush Creek, two miles southeast of the Sidney cut, have recently been received. This section is about 15 feet thick and contains two tills separated by an intervening nonglacial deposit, all overlain by post-glacial alluvial gravel. The intervening deposit is noncalcareous and consists of poorly-sorted and partly-rotted gravel overlain by mottled blue and brown clay, with a thin discontinuous peaty zone at the upper contact. Wood from near the base of the upper till is dated at  $22,000 \pm 1,000$  years (W-414) whereas a sample from the underlying peaty zone is dated at more than 37,000 years (W-415, M. Rubin, personal communication, May 18, 1956). The significance of these dates will be discussed in a later section where all implications concerning the glacial history will be considered.

<sup>1</sup>The terms "Early" Wisconsin and "Late" Wisconsin, as used in this paper, follow the usage of R. P. Goldthwait (1952, 1955). Basic Wisconsin stratigraphy in Ohio appears to be a lower till, overlain by gravel, which is in turn covered by a surface till. A buried soil, developed at the top of the gravel, marks an ice-free period of sufficient duration for soil formation. Materials pre-dating the soil are called Early Wisconsin; those post-dating the soil are called Late Wisconsin. In this paper the term "mid-Wisconsin" is used to refer to the period of soil formation.





## STRATIGRAPHY

Five tills are present in the Sidney cut. The tills vary somewhat in mechanical composition, but not enough to be identified in occurrence elsewhere; the differences are best observed in the face of the cut. Evidence for repeated disappearance of ice from this spot lies at the top of each of four of these tills. The type of evidence varies, being the presence of a soil above the first (top) and fourth tills, the presence of a boulder pavement and sand above the third, and the presence of fossiliferous silts above the fifth (lowest). The section is as follows:

<i>Unit</i>	<i>Description</i>	<i>Thickness (feet)</i>
9	Till, reddish-brown, with clayey loam texture, with small silt or sand lenses, discontinuous surface distribution, soil profile leached 24 to 27 inches. ....	0-7+
8	Till, brown, loam texture, very pebbly; soil profile is leached 43 or so inches where it reaches the surface. ....	5±
7	Sand, fine, well sorted and bedded. ....	0-2
6	Till, reddish-brown above unoxidized gray till; loam texture. Embedded in top of till is a boulder pavement, without striae on boulders, developing along a remarkably straight and horizontal line. ....	4±
5	Buried soil, bright limonitic red at top, less red toward base, leached to a maximum of 4 feet, with dolomite pebble ghosts near bottom. Log was lying on this soil and incorporated soil material in the wood. ....	0-6
4	Till, gray-blue, clayey loam texture. ....	30±
3	Silt, brown, fossiliferous. ....	1½
2	Silt, gray, fossiliferous, seeming to grade into underlying till. ....	1½
1	Till, gray, silty loam texture, somewhat pebbly. ....	1+
	Base covered	

## REGIONAL RELATIONSHIPS

The Sidney cut occurs on the till plain outside (south of) the sequence of Late Wisconsin moraines present in western Ohio. Just to the northwest lies the Sidney moraine, so named because it underlies part of the town of Sidney.

Leverett (1902, p. 476) correlated this moraine with the Union City moraine from the west, but recent work in Shelby County (Forsyth, 1956) shows that the Union City moraine turns north, west of Lockington Dam, and is overridden by a younger moraine, the Bloomer moraine (named for a town on its crest in Miami County). This interpretation is based on the topographic pattern at the place of junction. The Union City moraine here has a northwestward trend and is not very high, becoming lower toward the north; the Bloomer moraine trends northeast-southwest, almost at right angles to the Union City moraine, and is markedly higher. To the north, the Mississinewa moraine overrides the Bloomer in the same fashion; here the relationships are even clearer and more striking.

The Sidney moraine appears to be older than any of the moraines discussed above. It may be traced westward across Turtle Creek to the area of junction of the Bloomer and Union City moraines west of Lockington Dam, where it appears to pass under the Bloomer moraine. The relationship of the Sidney and Union City moraines is not clear, but the former seems to pass under the Union City moraine also. This interpretation would make the Sidney moraine the oldest of all these Late Wisconsin recessional moraines in Shelby County. The Sidney cut lies to the south of this moraine, and is therefore even older.

## COMPOSITION OF THE MOLLUSCAN FAUNULES

The material collected consists of Mollusca obtained by sieving from two large samples from units 2 and 3 of the section. The sample from unit 2 yielded 238 specimens, that from unit 3, 286 specimens. The relative numbers of the species are shown in table 1.

## NATURE OF THE ENVIRONMENT

The genera represented, with the exception of *Fossaria*, are land pulmonate gastropods. *Fossaria parva* will live in very small, even temporary, bodies of water and its presence in unit 2 indicates nothing more than the existence of puddles or pools of water at the time when these snails were alive.

TABLE 1

*Composition of the molluscan faunules from units 2 and 3 of the Sidney Cut, Shelby County, Ohio*

Species	Unit 2		Unit 3		Ohio
	Number	Percent	Number	Percent	Now
<i>Carychium exile canadense</i> Clapp	27	11.4	11	3.8	No
<i>Cionella lubrica</i> (Müller)	1	0.3	1	0.4	Yes
<i>Columella alticola</i> (Ingersoll)	0	—	11	3.8	No
<i>Deroceras?</i> sp.	0	—	1	0.4	?*
<i>Discus cronkhitei</i> (Newcomb)	0	—	1	0.4	Yes
<i>Euconulus?</i> sp.	1	0.3	0	—	?*
<i>Fossaria parva</i> (Lea)	8	3.4	0	—	Yes
<i>Hawaitia minuscula</i> (Binney)	0	—	4	1.4	Yes
<i>Helicodiscus</i> sp.	2	0.8	0	—	?*
Helicoid, undetermined fragments	4	1.7	0	—	?*
<i>Stenotrema</i> sp.	9	3.8	8	2.8	?*
<i>Succinea avara</i> Say	39	16.4	59	20.6	Yes
<i>Succinea grosvenori</i> Lea	76	32.0	24	8.4	No
<i>Vallonia gracilicosta</i> Reinhardt	9	3.8	76	26.5	No
<i>Vertigo alpestris oughtoni</i> Pilsbry	62	26.1	90	31.5	No

\*These specimens could not be identified to species, in one case not even to genus, because of their fragmentary condition. It is probable that the species represented occur in Ohio but they must be recorded as doubtful in the absence of specific identification.

An uneven land surface such as might be developed on the surface of a ground moraine would have hollows in which *Fossaria parva* could establish itself and survive. This sort of environment would also be suitable for *Succinea grosvenori*. Along the margins of the pool, *Carychium*, *Cionella*, and *Helicodiscus* would find a congenial habitat. On the higher, somewhat drier ground, *Euconulus*, *Stenotrema*, *Succinea avara*, *Vallonia*, and *Vertigo* would thrive, especially if vegetation covered the ground. There is no indication here of a forest cover or even light woods. A thick growth of bushy plants, such as alders, would be ideal. *Vallonia*, in fact, thrives with no more cover than a thick growth of grass and shrubs.

As the snails died, their shells would be washed into the hollows, along with silt and dead leaves. In the situation presented by units 2 and 3 of this section, this could be accomplished by the flow of rain down the gentle slopes to the hollows. Eolian transportation could be a factor in the transfer of fine material from the higher ground to the hollows but there is nothing to indicate that it played a major role.

The filling in of the pool and the general leveling of the surrounding surface may account for the disappearance in unit 3 of *Fossaria parva* and for the dwindling numbers of *Carychium exile canadense* and *Succinea grosvenori* and the corresponding

increase in numbers of *Succinea avara*, *Vallonia gracilicosta*, and *Vertigo alpestris oughtoni*. It may also account for the appearance in unit 3 of *Columella alticola*, *Discus cronkhitei*, and *Hawaiiia minuscula*, although these may have been washed in from higher ground.

It is emphasized that the ecology of the fauna does not demand the presence of woods or forest. The nature of the section shows that the ice was not far away and that it overswept the area so soon afterwards that a forest cover may not have developed. Likewise, the habitat preferences of the Mollusca are such that they could easily have existed with a minimum of bush-like plants to provide what little shade they needed.

The presence of ice a short distance away does not seem to have affected the development of a land snail population to any great extent. The two assemblages described could be duplicated at the present time in the southern parts of eastern Canada, as far west as Manitoba.

TABLE 2  
Stratigraphic range of identified species of the Sidney Cut faunules

Species	PLIO	NE	AF	KA	YA	IL	SA	WIS
<i>Carychium exile canadense</i> Clapp	O	O	O	X <sup>a</sup>	X <sup>f</sup>	X <sup>f</sup>	X <sup>f</sup>	X <sup>e</sup>
<i>Cionella lubrica</i> (Müller)	O	O	O	X <sup>a</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>
<i>Columella alticola</i> (Ingersoll)	O	O	O	O	O	O	O	X <sup>e</sup>
<i>Discus cronkhitei</i> (Newcomb)	O	O	O	X <sup>d</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>
<i>Fossaria parva</i> (Lea)	O	O	X <sup>e</sup>	X <sup>a</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>
<i>Hawaiiia minuscula</i> (Binney)	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>d</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>
<i>Succinea avara</i> Say	O	O	O	X <sup>a</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>b,c</sup>
<i>Succinea grosvenori</i> Lea	O	O	X <sup>e</sup>	X <sup>a</sup>	X <sup>e</sup>	X <sup>d</sup>	X <sup>e</sup>	X <sup>e</sup>
<i>Vallonia gracilicosta</i> Reinhardt	O	O	X <sup>e</sup>	X <sup>d</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>e</sup>	X <sup>d</sup>
<i>Vertigo alpestris oughtoni</i> Pilsbry	O	O	O	X <sup>g</sup>	X <sup>f</sup>	X <sup>f</sup>	X <sup>e</sup>	X <sup>b,c</sup>

Explanation of Symbols

PLIO	Pliocene	<sup>e</sup>	Ohio (Leonard, 1953, p. 372).
NE	Nebraskan	<sup>d</sup>	Kansas (Frye and Leonard, 1954, p. 45).
AF	Aftonian	<sup>e</sup>	Kansas (Leonard, 1950).
KA	Kansan	<sup>f</sup>	By inference, from the existence of a Kansan record.
YA	Yarmouth		
IL	Illinoian	<sup>g</sup>	Indiana, pro-Kansan (Wayne, personal communication).
SA	Sangamon		
WIS	Wisconsin	O	Absent.
<sup>a</sup>	Indiana, pro-Kansan (Wayne, 1954)	X	Present.
<sup>b</sup>	Indiana (Wayne and Thornbury, 1955, p. 26).		

It should be noted also that there is no indication here of the nearness of a stream or of a body of water such as a lake or even a large pond. Stream valleys to the east, south, or west may have accelerated the dispersal of these snails to the Sidney area, but once in the general region, they were able to spread out and occupy the rather wet environment of the uneven moraine surface.

AGE OF THE SIDNEY CUT FAUNULES

In Ohio, age determinations on the basis of molluscan faunules must be made with extreme caution and on a conditional basis for three reasons. In the first place, few assemblages have been studied in sufficient detail to serve for comparison with newly discovered faunules. Secondly, certain species, hitherto considered characteristic of a particular part of the Pleistocene, have later been recorded for younger or older sediments, which has led to modification of ideas on their strati-

graphic significance. Thirdly, species of proven stratigraphic significance in other states, for example in Kansas, where so much has been accomplished by Leonard, may have a different value in Ohio because of different factors influencing the dispersal of Mollusca.

Under these circumstances, all that can be done with these collections from the standpoint of age determination is to assemble all available information on the geologic range of the species in Ohio and elsewhere and to draw provisional conclusions on the basis of these data. In spite of these limitations and uncertainties, a fairly definite conclusion can be obtained concerning the age of the Sidney Cut faunules.

The stratigraphic range of the identified species and forms, so far as known at present, is shown in table 2. The two collections are not separated in this table; they are so close stratigraphically and lithologically that no good purpose would be served by considering them separately. Identifications to genus only have not been included in the list; data from these determinations are too general to have any significance.

The two collections contain five species that are not now living in Ohio. Four of these, *Succinea grosvenori*, *Vertigo alpestris oughtoni*, *Vallonia gracilicosta*, and *Columella alticola*, are entirely absent from the living molluscan fauna of Ohio. The other is represented in Ohio by the typical form but its variety or subspecies, *Carychium exile canadense*, has not been found living in the state. Such a high proportion of locally extinct species (50 percent of forms identified to species) has been considered significant in Ohio and elsewhere and indicates at least Wisconsin age.

An age determination older than Kansan for this deposit seems to be out of the question. Six of the Sidney Cut species have not been recorded for Aftonian deposits and nine of them do not appear in Nebraskan lists.

The position of the deposit under several tills suggests the possibility of a Sangamon, Illinoian, or Kansan age. Of the ten species of the Sidney Cut list, only one, *Columella alticola*, has not been recorded for Sangamon deposits. Only two, *C. alticola* and *Vertigo alpestris oughtoni*, have not been recorded for Illinoian, Yarmouth, and Kansan deposits, but it must be pointed out, in fairness to those who incline to an Illinoian age for the Sidney Cut deposit, that *V. alpestris oughtoni* has been collected by Wayne (personal communication) from pro-Kansan deposits in Indiana. The objection to a Sangamon, Illinoian, or Kansan age rests, therefore, on the occurrence of *C. alticola* in the Sidney Cut deposit and its absence from older Pleistocene deposits.

On the other hand, all the species of the Sidney Cut faunule, including *Columella alticola*, have been recorded from Wisconsin deposits, seven of them by Leonard (1953) from the Wisconsin of the Cleveland region in Ohio.

Advocating an Illinoian age for the Sidney Cut faunule might present a dilemma familiar to all stratigraphic paleontologists: to rely on evidence provided by fossils or to rely on an interpretation based on geological relationships. In this particular case, in order to interpret the Sidney Cut faunule as older than Wisconsin, it must be assumed that *C. alticola* occurs in Pleistocene deposits older than Wisconsin. The assumption is not an impossible one, since the range of other species has been extended in the past. Nevertheless, the fact remains that, so far, *C. alticola* has not been found in deposits older than Wisconsin in Kansas, Illinois, Indiana, or Ohio. In addition, geological evidence favors a Wisconsin age somewhat more strongly than an Illinoian one. Under these circumstances, the dilemma does not appear to exist and we conclude, therefore, that the Sidney Cut faunule must be considered of Wisconsin age unless and until new data indicate otherwise.

The large proportion of extinct species already mentioned leads us to prefer

an Early rather than a Late Wisconsin age but this is only a preference insofar as the Mollusca indicate. It seems to be a logical one, nevertheless, considering the stratigraphic position of the deposit under several tills. It seems to us that if the Sidney Cut faunule is considered to be Wisconsin in age, it must be placed near the beginning of Wisconsin time in Ohio.

#### GEOLOGIC IMPLICATIONS OF AGE OF FAUNULE

Data concerning the age of the buried soil in the Sidney cut, and therefore the glacial history of west-central Ohio, are drawn from regional stratigraphy, the radiocarbon datings, the character and development of the buried soil, and the mollusk study just discussed.

The till lying above the buried soil in the Sidney cut is definitely Late Wisconsin, for the radiocarbon date of  $23,000 \pm 800$  years on the log (and also of  $22,000 \pm 1,000$  years on the log from the younger till at upper Brush Creek) is consistent with the pattern of Late Wisconsin datings throughout Ohio (Flint, 1955; Flint and Rubin, 1955; Rubin and Suess, 1956).

The soil lying just below the Late Wisconsin log has been interpreted by some as Sangamon because it appears so well developed. If this should be so, the Early Wisconsin ice would have had to come and go without leaving a trace. Though such a history is not impossible, it seems unlikely. Buried soils developed in gravel are present in many other localities throughout west-central Ohio; a typical example occurs only four miles north of the Sidney cut. These soils are of mid-Wisconsin age. Postulating two distinct stages of soil formation, rather than one, avoids the simplest interpretation and demands substantiation by adequate supporting data. Tests run in the Soils Testing Laboratory (Agronomy Department, The Ohio State University) on the chemical and mechanical composition of the buried soil seem to show a soil development no greater than in a similar modern soil; this is not the intensity of development that would be expected in a soil formed during Sangamon time.

A thick till separates the buried soil from the silts in which the mollusks were found. It has been suggested above that the age of the mollusks is most likely Early Wisconsin, less likely Sangamon, or very unlikely Illinoian. If the most likely age assignment is accepted, that of Early Wisconsin, it follows that the buried soil must be mid-Wisconsin. Even if the less likely Sangamon age for the faunule is adopted, the thick till separating the fossiliferous silts from the buried soil demands the presence of ice, which would have to be of Early Wisconsin age; so again one is led to a mid-Wisconsin date for the buried soil. Since the silts are thin and grade downward into the underlying till, the interval represented by the silts is probably not great; it is not likely to mark an interstadial deposit. If the buried soil is called Sangamon, which has been seriously questioned above, the fossils would have to be of Illinoian age; this has been shown to be very unlikely. This fauna is therefore called Early Wisconsin, and the buried soil above it is assigned to the mid-Wisconsin substage, thus correlating it with the numerous other examples of mid-Wisconsin buried soils in west-central Ohio.

The implications of the older radiocarbon dating on peat beneath the younger till at upper Brush Creek must also be considered. The age determination of this peat as greater than 37,000 years is similar in value to several other determinations from Ohio. The geologic age implied was not known except that it was pre-Late Wisconsin. Correlation of the upper Brush Creek section with the Sidney cut suggests that the upper Brush Creek peat is also Early Wisconsin, thus implying that many deposits assigned dates of about this value may be of Early Wisconsin age.



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## REFERENCES CITED

- Flint, R. F.** 1955. Rates of advance and retreat of the margin of the late-Wisconsin ice sheet. *Amer. Jour. Sci.* 253: 249-255.
- and **M. Rubin.** 1955. Radiocarbon dates of pre-Mankato events in eastern and central North America. *Science* 121: 649-658.
- Forsyth, J. L.** 1956. Glacial geology of Logan and Shelby Counties, Ohio. Ph. D. Thesis (Unpublished), The Ohio State University, Columbus.
- Frye, J. C. and A. B. Leonard.** 1954. Significant new exposures of Pleistocene deposits at Kirwin, Phillips County, Kansas. *Geol. Surv. Kansas, Bull.* 109, pt. 3, pp. 33-48, 3 pls., 3 figs.
- Goldthwait, R. P.** 1952. Guidebook of the 1952 Field Conference of the (Eastern) Friends of the Pleistocene. Ohio Division of Geological Survey.
- . 1955. Pleistocene Chronology of Southwestern Ohio. Guidebook for the Fifth Biennial Pleistocene Field Conference Ohio Division of Geological Survey, pp. 35-72.
- Leonard, A. B.** 1950. A Yarmouthian Molluscan Fauna in the Midcontinent Region of the United States. *Univ. Kansas, Paleont. Contrib., Mollusca*, art. 3, pp. 1-48, pls. 1-6, figs. 1-4.
- . 1953. Molluscan faunules in Wisconsinan Loess at Cleveland, Ohio. *Am. Jour. Sci.* 251: 369-376, 1 pl., 1 fig.
- Leverett, F.** 1902. Glacial Formations and Drainage Features of the Erie and Ohio Basins. U. S. Geol. Survey, Monograph 41, 802 pp.
- Rubin, M. and H. E. Suess.** 1955. U. S. Geological Survey radiocarbon dates II. *Science* 121: 481-488.
- . 1956. U. S. Geological Survey radiocarbon dates III. *Science* 123: 442-448.
- Wayne, W. J.** 1954. Kansan till and a pro-Kansan loess faunule from Indiana. *Geol. Soc. Am., Bull.* 65: 1320.
- and **W. D. Thornbury.** 1955. Wisconsin Stratigraphy of Northern and Eastern Indiana. Guidebook, Fifth Biennial Pleistocene Field Conference, pp. 1-34.
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